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Japanese Patent

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FLUIDIZED BED TYPE BIOLOGICAL SEWAGE TREATING METHOD

(流動床式生物学的汚水処理方法)

(Akira Uchida)

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Inventor	:	Tohru Yamauchi
Applicant	:	Mitsubishi Heavy Industry Co.,
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Specification

1. [Title of the invention]

Fluidized bed type biological sewage treating method

2. [Scope of the patent claims]

Regarding fluidized bed type biological sewage treating method, the characteristics is that as microorganism carrier, iron or iron oxide powder is used singly or by two types or more, and sewage is treated biologically by the microorganism adhered to said carrier, treated water obtained by same treatment is discharged via magnetic field.

3. [Detailed explanation of the invention]

The present invention relates to the method of biologically treating the fluidized bed type contaminated product in sewage (BOD, cOD, BB and others), and particularly to a method wherein, as microorganism carrier, iron or iron oxide (these are always magnetized or one that are magnetized by a strong magnetic field) is used, and by providing magnetic field inside treatment system, efficient treatment can be provided.

Hence, traditionally, fluidized bed type biological sewage treating method was executed by the apparatus as shown in figure 1.

In figure 1, 'a' is a sewage (water to be treated) in-flow line, 'b' is an in-flow line of air, oxygen or oxygen containing gas, 'c' is in-flow line of treating water, 'd' is a flow status of

substance (fluid and solid) inside the apparatus, 'e' is a inflow pipe of the original water (water to be treated), (that is, the supply pipe of sewage and the like that contains the sewage product), 2 is an inflow pipe of air, oxygen or oxygen containing gas, 3 is a dispersion apparatus of gas (forms fine gas bubble), 4 is an outer plate of the apparatus, 5 is a inner cylinder (the climbing pipe of gas bubble or the fluid or climbing area constituting means), 6 is ?, 7 is a trough for taking out treating water, 8 is a in-flow pipe of treating water, 9 is water surface.

As carrier, a suitable amount of sand or anthracite is thrown into the apparatus main unit 4 and an inside cylinder 3, and filled up, line a and line b are driven. On the surface of sands or anthracite are adhered microorganism that was [illeg] in the original water supplied from a line a, thus, the treatment of sewage product in said original water starts. The particles of carrier + microorganism move inside as shown by the arrow 'd'. And, the movement of carrier + microorganism is shown in figure 2 schematically.

When it climbs inside cylinder 5, the microorganism and fluid receives the oxygen supply and microorganism purifies the sewage. Microorganism excessively grown is flown out from a line c.

Immediately after Sands or anthracite (carrier) is injected, said carrier does not go around along the arrow 'd' in any way. Once microorganism starts to adhere to this, adhered one has

decreased weight; hence, it starts to flow with the fluid along the arrow 'd'. Soon when [illeg] is over, entire carrier is adhered to microorganism, and flows along he arrow 'd'.

This microorganism- adhered carrier has decreased weight as microorganism has adhered thereto, however, compared with water, it is larger, hence, in general, sinking characteristics is good, and hence, it is designed such that it does not arrive at flow-out pipe 8 from a trough 7 via a vessel 6, hence, it is not necessary to have a special contrivance for a vessel 6 and a trough 7.

However, along with the increase of adhering amount of microorganism, microorganism- adhering carrier decreases in its equivalent weight, and many times, the part that has direct contact with carrier become magnetic, hence, N2 by biochemical denitrification action and H2S by sulfur reduction [illeg] are generated, and the gas bubble caused by N2, H2S or CO2 that was generated in excess and could not be dissolved in water and the like is built into the microorganism- adhering carrier, its weight gets decreased furthermore, and approaches to weight of water.

When arriving at such a condition, microorganism- adhering carrier starts to flow out from ?6, and unless this flow out is prevented, the absolute amount of microorganism that treats sewage decreases, not only the treatment of sewage in the original water becomes impossible, but also, it becomes necessary to replenish the carrier that existed at the flow out, thus increasing the

running cost. On the other hand, in order to prevent the flow out, if special shaped apparatus main unit 04, a vessel 6 and a trough 7 are contrived, it takes on a complex treatment, thus increasing the facility cost.

The purpose of the present invention is to remove such defects, and to prevent the flow out of microorganism- adhering carrier using a simple method, and relates to the fluidized bed type biological sewage treating method wherein the characteristics is that as microorganism carrier, iron or iron oxide powder is used singly or by two types or more, and sewage is treated biologically by the microorganism adhered to said carrier, treated water obtained by same treatment is discharged via magnetic field.

The following explains the method of the present invention in detail along the attached drawings.

Figure 3~6 show examples of the apparatus used when method of the present invention is used, figure 3 is an example in case the path 12 later described is mounted to the lower direction part among the arrow 'd' showing the flow condition of substance (fluid and solid) inside aforementioned apparatus, figure 4 is a modified example of figure 3, figure 5 is a case where the above described path 12 is mounted on the upper direction part among the above described arrow 'd', figure 6 is an example in case above described path 12 is mounted on the downstream side of same a vessel 6 and a trough 7 same as aforementioned figure 1.

Among figure 5~6, the same symbols as in figure 1 show identical function parts as figure 1, and 10 is a magnet (permanent magnetic stone or electric magnetic stone), 11 is a metal type filter (single or multiple), material quality is that it can be magnetized by magnetic field, but when the magnetic field is removed, residual magnetism is small, and also, when used for treating water, there is no corrosion problem, for instance, SUS 316 and the like are used. 12 is a path between apparatus main unit 4 and above described filter 11, 13 is a temporary storage vessel of microorganism-adhering carrier, 14 is a pump, arrow 'a' is a flow that arrives at filter 11, arrow 'f' is the flow wherein microorganism- adhering carrier recovered by filter 11 returns to the apparatus main unit 4, arrow 'g' is the moving direction when magnet 10 is permanently magnetized.

And, as the microorganism- adhering carrier for the method of the present invention, the powders such as iron (Fe), magnetite (Fe3 O4), hema tite (Fe2 O3) and the like and one that are constantly magnetized, or one that is magnetized by a strong magnetic field are used, and these are used singly or combined by two or more. (Hereafter, these are called iron powder carrier).

Next, the operations of the method of the present invention will be described in detail in case apparatus in figure 5~6 are used, and regarding the operation, there are direct ones and indirect ones, and they will be described in sequence.

(1) direct action:

The microorganism attaches to the surface of iron powder carrier and grows and the contaminant is purified biochemically by this microorganism. As the microorganism grows, the weight of microorganism- adhering iron powder carrier decreases as described before. When the flow out is about to occur to the line 'c' outside the system, due to the action of magnet 10, magnetic gradient to the filter 11 is generated by magnet 10, and although microorganism- adhering iron powder carrier flows along the arrow'?' as the iron powder carrier gets magnetized, it can not pass through the filter 11, it is held in a condensed condition in front of the filter 11.

If it arrives at a fixed condensation condition, then, in case magnet 10 is an electric magnet, the electricity is stopped, and in case it is a permanent magnet, as shown in the arrow 'g', an operation is executed such as shifting from the vicinity of filter 11, thus, microorganism- adhering iron powder carrier moves in the direction shown by an arrow 'f', and in case of figure 3~5, it returns to apparatus main unit 4 directly, and in case of figure 6, it returns to apparatus main unit 4 via storage vessel 15 and pump 14.

(2). Indirect operation:

(I). although explained in the prior arts, microorganism grown in excess (in general called excess sludge) separates from the carrier,

and gets mixed with treating water in suspension (in general) and flows out. On the other hand, in case of the present invention, it can be controlled freely and discharged; the concentration inside the apparatus main unit 4 of the microorganism to be attached to the carrier can be controlled. That is, the concentration of the microorganism inside the apparatus main unit 4 can be increased. If much microorganism amount can be maintained, the treatment amount and/ or treatment characteristics of the contaminated substance can be improved that much (treatment amount is in proportion to the microorganism concentration that is maintained.)

This mechanism is explained as follows. Microorganism- adhering iron powder carrier that came in via the arrow 'e' right in front of filter 11 gets condensed. Then, condensed zone is created that has the boundary of the surface right at a filter 11. and this zone has the function that correspond to the blanket zone of the condensed sedimentation, and it is difficult for the microorganism to be attached to the carrier to move further than a filter 11,by the action to be filtered by this zone (that is, it is held). And it can be returned to apparatus main unit 4 again (the operation is performed wherein if magnet 10 is an electric magnet, the power is turned off, and if it is a permanent magnet, the position is shifted).

And in order to control the concentration optionally, it can be attained by the operation of magnet 10. that is, if in case of an electric magnet, the operation to stop the power, and in case

of a permanent magnet, the operation to shift the position is repeated early, above described zone can not be formed, but is discharged to the line 'e', thus the concentration is reduced, and if this operation is slowed down to form above described zone, the concentration can be increased.

(II). iron powder carrier elutes Fe ion albeit a minute amount. The microorganism attacked to the iron powder carrier coexists with the hydroxide of Fe ion that eluted. This hydroxide has the following two operations.

First of all, inside the inside cylinder 5, it takes on Fe (OH)2 shape, and outside the inside cylinder 5 shown as the downward part of the arrow 'd', a part of Fe(OH)2 changes. That is, inside cylinder 5, reaction of $2Fe(OH)2 + O2 + H2O \rightarrow 2Fe(OH)2$, and outside of the inside cylinder 5, the reaction of $2Fe(OH2) \rightarrow (O2) + H2O + Fe(CH)2$ are generated. And, O2 in parenthesis does not become air bubble, but takes on the shape of supplying to the coexisting attached microorganism. This is quite important, and this takes in the oxygen supplied from the line 'a' inside the inner cylinder 5, it not only gets dissolved in water but also, supplies to the microorganism-adhering iron powder carrier as shown in the above described reaction formula. Regarding the taking in of O2 by the supply to microorganism-adhering iron powder carrier, it is not traditional sands or anthracite carrier. That is, if it is supplied from line 'a' such as same air, it is compared to the prior art, and if it is method

of the present invention, it means that oxygen inhalation is good that much, and the oxygen taken in in the microorganism- adhering iron powder carrier can be used in the form of (O2) of the reaction formula shown above, helping the oxygen deficiency prevention.

In [illeg] 2, hydroxide of above described iron forms one flock along with the microorganism formed in excess at the end and gets discharged outside the system, and along with said excess microorganism, it is recovered as a cake via the operation such as precipitation separation and centrifugal dehydration and the like, thus taken care of. Like this, in case iron hydroxide forms one block with the microorganism and gets discharged, as in the past, compared with the case chemicals such as iron hydroxide and the like are added separately for the purpose of precipitation separation and centrifugal hydration and the like, since iron hydroxide product (iron hydroxide)are quite adapted to microorganism [illeg], precipitation separation and dehydration effects are very good, hence, even in case it is necessary to add chemicals such as iron hydroxide for precipitation separation and dehydration, it is sufficient even if the additive amount can be quite very small.

The effect by method of the present invention explained above will be explained specifically using embodied example.

[Embodied examples]

(a). the following testing was done to confirm the effect by magnetic field.

Using the magnetite of average particle diameter 2μ as iron powder carrier, and MLC88 concentration 3000 ppm, vertical speed LV of the wave that traverses the magnetic field and intensity of the magnetic field are changed, the replenishing rate by the filter of microorganism- adhering iron powder carrier is measured. And, as said filter, the line of 0.2mmΦ made of SUS 516 L is formed into the net of 5 mm□ shape, is laminated into 5 layers and used. The result is shown in table 1.

Table 1

LV(??/Hr)	Intensity of magnetic field (gause)	Replenishing rate by a filter (%)
50	500	99.9
50	1,000	99.9
100	500	99.9
100	1,000	99.9
200	500	99.9
200	1,000	99.6

(b) In order to confirm the condensation effect by a filter part, the following test was done.

Doing the testing under the same condition as in above described (1), using the filter part two hours after passing water, and its

MLV88 concentration was measured. The result is as shown in table 2.

LV(??/Hr)	Intensity of magnetic field (gauze)	Filter part MLV88 (ppm)
50	500	About 80,000
100	500	About 75,000
100	1,000	About 65,000

And according to the observation of the outer appearance, the condensation range tended to go down to the lower layer a little by little.

Summarizing the effect of method of the present invention, it is as follows.

(1). the flow out of microorganism- adhering carrier can be prevented (there is no need for replenishing, running cost reduction can be obtained).

(2). Microorganism concentration inside the treatment apparatus main unit can be controlled freely (high concentration can be maintained, and the treatment amount of the contaminant can be increased by the same apparatus and/or its treatment characteristics is improved. That is, this makes the apparatus efficient and compact.)

(3). the condensation agent and the like added for treating when microorganism grown in excess is recovered and dehydrated and the like can be decreased (after-treatment facility is made compact and running cost is reduced)

(4). at the part of the climbing tube of gas and fluid, the oxygen inhalation rate is increased and oxygen deficiency in the vessel is prevented (this maintains the active level of the microorganism and blow-in oxygen is utilized with high efficiency).

And, if the existing high gradient magnetic filter is just assembled into the existing fluidized bed type biological sewage treating method, only above described (1) effect can be obtained, however, according to method of the present invention, above described (3) and (4) effects are obtained by using above described iron powder carrier where the above described (2) operation effect is produced by generating the high concentration zone on the filter surface.

4. [Simple explanation of the drawings]

Figure 1 is an explanation drawing of the apparatus used for the traditional fluidized bed type biological sewage treating method Figure 3~6 are the explanation drawing of the example of the apparatus sued when method of the present invention is used.

Figure 1

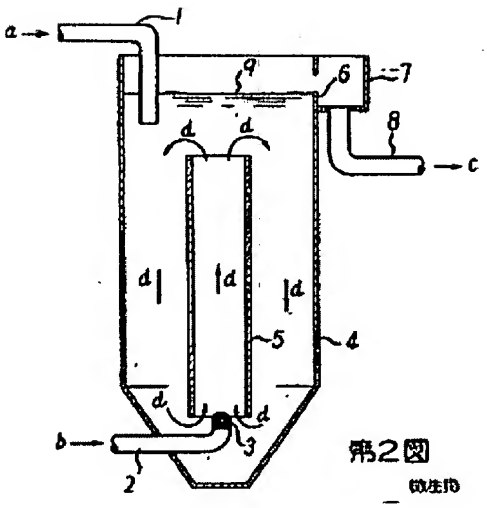
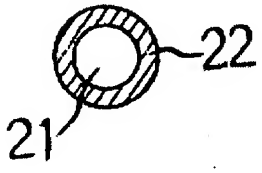


Figure 2



Microorganism

Sands

Figure 3

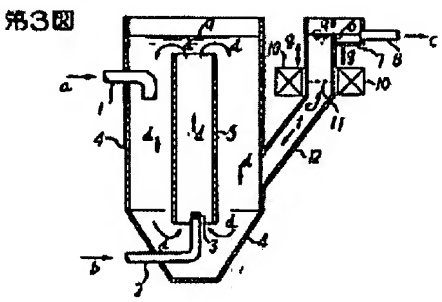


Figure 4

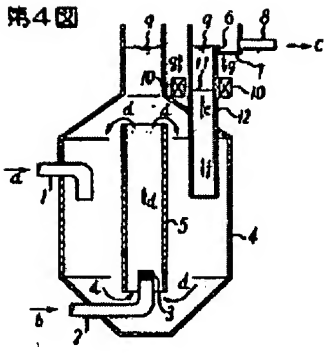


Figure 5

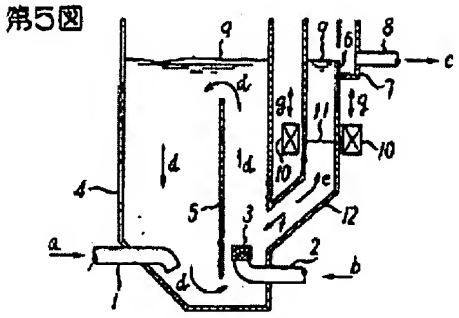
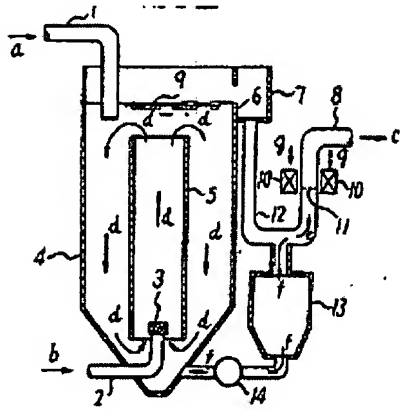


Figure 6



Procedure correction document

October 5, 1981

To: Harkin Shimada, Chief of the patent office

Date of correction instruction

September 5, 1981 (sent out September 29, 1981)

The content of the correction

(1). After the word [show] on the first line on page 5 of the specification, insert that 21 is the carrier (sand), and 22 is microorganism]

In the figure 2.

(2). after [explanation drawing] in the second line on same page 15, insert [second figure is a drawing schematically showing carrier + microorganism configuration]